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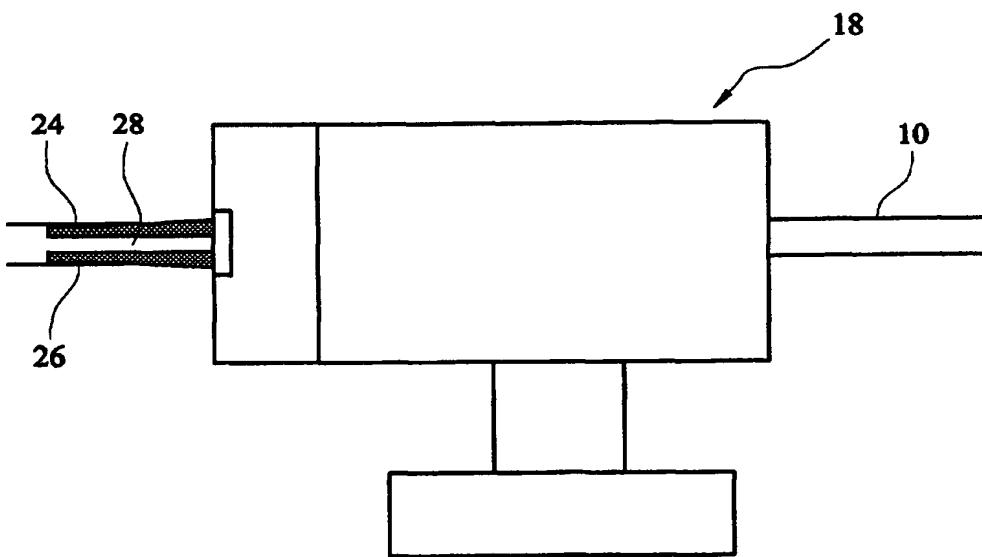
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ance Notes on Codes and Abbreviations" appearing at the begin-  
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(54) Title: MATRIX ASSEMBLY



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(57) Abstract: A method of forming a matrix assembly is disclosed which comprises providing a steel strip (10), treating the upper surface of the steel strip with a resin adhesive, extruding one or more plastic material strips (24, 26) onto the metal strip to define a longitudinal channel (28) and heating the assembly so formed to cure the resin adhesive and adhere the plastic material to the metal strip. The method of the invention obviates the need to perforate the metal strip and this leads to a number of advantages. Firstly, omitting the perforation step enables the matrix assembly to be produced more cheaply. Secondly, with there being no perforations present, it is possible to use a thinner steel strip (for example, of thickness of 0.002") and still retain adequate strength. This means that no modification need be made to the height of the creasing dies in a cutting and creasing press.

## MATRIX ASSEMBLY

This invention relates to the scoring or creasing of card-like material and, more particularly, relates to a method of manufacturing a matrix assembly for use in forming creases or score lines in card-like material, and to the matrix so formed.

Card-like material is creased to facilitate it being folded into its final shape by pressing the material between a creasing rule of a cutting and creasing press, and a creasing matrix. The creasing matrix comprises a long flexible strip having a channel formed longitudinally therein which is slightly wider than the creasing rule. The matrix strip is fastened to a press platen so that its channel is aligned with the creasing edge so that on closing the press the rule edge urges the portion of the card comprising the crease into the matrix channel to provide a well defined crease. In our European patent publication number 0107490 there is disclosed a form of matrix assembly which is widely used in cutting and creasing presses. The matrix generally comprises a steel strip onto which has been extruded one or more strips of plastic material to define a channel running longitudinally of the strip, the plastic material being adhered to the strip by means of perforations formed therein to which the plastic material can "key".

Typically, the steel strips used in the above form of matrix are of one of two thicknesses, 0.004" and 0.006". These thicknesses are required in order to give adequate strength owing to the presence of perforations. This thickness of steel strip required a reduction in the height of creasing rules used in cutting and creasing dies. Clearly it would be advantageous if a matrix could be formed of adequate strength which is sufficiently thin so as not to require modification of the height of the creasing rules of the cutting and creasing press.

The invention seeks to provide a method of forming a matrix, and a matrix so formed improved in the above respects.

According to a first aspect of the present invention, there is provided a method of forming a matrix assembly which comprises providing a steel strip, treating the upper surface of the steel strip with a resin adhesive, extruding one or more plastic material strips onto the metal strip to

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define a longitudinal channel and heating the assembly so formed to cure the resin adhesive and adhere the plastic material to the metal strip.

The invention further comprises a matrix strip assembly made in accordance with the above method.

The method of the invention obviates the need to perforate the metal strip and this leads to a number of advantages. Firstly, omitting the perforation step enables the matrix assembly to be produced more cheaply. Secondly, with there being no perforations present, it is possible to use a thinner steel strip (for example, of thickness 0.002") and still retain adequate strength. This means that no modification need be made to the height of the creasing dies in a cutting and creasing press.

The surface of the previous matrix strip was rough owing to the presence of the perforations beneath the plastic, whereas the surface of the strip in accordance with the present invention is smooth, and there is therefore no embossing of board or card creased therewith. Furthermore, delamination, which could be caused with the previous matrix assembly when the strip was cut or mitred at the point of a perforation, now no longer occurs.

The absence of perforations also gives a longer running life and the plastic profile of the matrix assembly of the invention has an improved finish. Finally, waste is greatly reduced.

Preferably, the adhesive resin employed is a polyurethane or polyolefin resin. This is preferably applied to the surface of the steel strip in a continuous manner immediately before the latter passes into an extrusion die where the plastics material is attached thereto by extruding the plastic material profile onto the resin treated steel strip downstream of the extrusion die in a process called external crosshead extrusion. The advantage of this method is that the steel strip is not under significant pressure from plastic material in the crosshead die, allowing the use of thinner (e.g. 0.002") steel without deformation, and because of the fact that the strip freely passes through the crosshead die, the tooling life is increased greatly. The plastic extrusions may be controlled and guided into position externally of the crosshead die by a series of horizontally and vertically micrometer adjustable heated precision rollers ensuring complete

accuracy of size for both sides of the matrix, in respect of height, width and profile. Thereafter, the assembly passes to a heating zone to cure the adhesive resin and effect bonding of the matrix. Following this, the assembly is cooled, pulled off and further assembled in-line with a double-sided pressure sensitive adhesive tape to the bottom of the matrix, after which it is cut into suitable lengths for packaging and onward transmission.

The plastic material adhered to the steel strip may be any suitable plastics material, but is preferably polypropylene. The metallic material may also be any suitable metal, but is preferably steel. The strip may be conditioned and degreased before use, for example, using a propane torch or the like.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram illustrating the method of the invention;

Figure 2 is a plan view of the die and adaptor on an enlarged scale;

Figure 3 is a cross-section of the die and adaptor; and

Figure 4 is a front elevation of the die.

Referring to the drawings, and in particular Figure 1, a steel strip 10, which may have been pre-conditioned, is pulled between a haul off mechanism 12 and a brake mechanism 14. Between the latter devices it is treated in accordance with the invention as follows.

Firstly, the strip 10 enters a slot coat station 16 where polyurethane or a polyolefin hotmelt resin is applied to its upper surface. The strip 10 then passes into the die 18 portion of an extruder 20 where a polypropylene plastics material 22 is extruded onto the steel strip 10 to form two parallel longitudinal strips 24,26 defining between them a channel 28. The plastic extrusions may be controlled and guided into position externally of the crosshead die by a series of horizontally and vertically micrometer adjustable heated precision rollers in a roller station

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29 ensuring complete accuracy of size for both sides of the matrix, in respect of height, width and profile

The assembly then passes into a heating unit 30 where the polyurethane is cured, bonding the strips 24,26 to the metal strip 10 and forming the matrix assembly. The plastic material is preferably provided with a blowing agent, the latter helps stabilise the modified polypropylene preferably employed, eliminating shrinkage of the plastics material profile. The temperature of the extrusion and polyurethane cure zone 30 is preferably high, in the region of 250°C, to effect curing.

The assembly then passes into a cooling zone 32, preferably comprising a vortex for rapid cooling. Further cooling may be provided, after which the assembly advances to the haul off winder unit 12. The matrix is combined with a double-sided adhesive tape in a combining zone 34 where the tape is applied to the underside of the matrix strip 10. Thereafter, the matrix assembly may be encoded, cut into predetermined lengths and packaged as is known *per se*.

The absence of perforations in the metal strip 10 enables a thinner strip to be used than was heretofore possible and the finished matrix assembly is therefore thinner, whilst still having adequate strength. It can therefore be used in standard cutting and creasing presses without having to modify the cutter height.

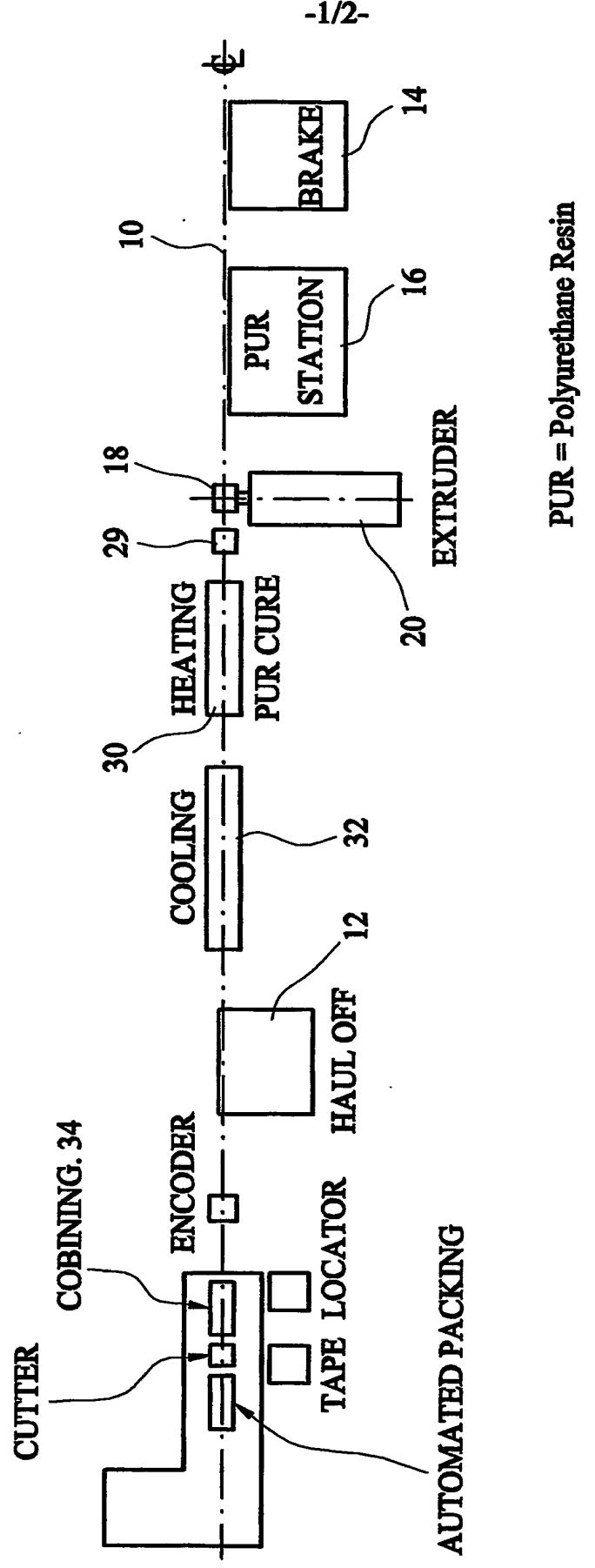
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## CLAIMS

1. A method of making a matrix assembly which comprises providing a steel strip (10), treating the upper surface of the steel strip with a resin adhesive, extruding one or more plastic material strips (24,26) onto the metal strip (10) to define a longitudinal channel (28) and heating the assembly so formed to cure the resin adhesive and adhere the plastic material (22) to the metal strip.
2. A method as claimed in claim 1 wherein the adhesive resin employed is a polyurethane or polyolefin resin.
3. A method as claimed in either of claims 2 or 3 wherein the resin is applied to the surface of the steel strip (10) in a continuous manner immediately before the latter passes into an extrusion die (18) where the plastics material (22) is attached thereto by extruding the plastic material profile onto the resin treated steel strip downstream of the extrusion die.
4. A method as claimed in any of claims 1 to 3 wherein the plastic extrusions (22) are controlled and guided into position externally of the extrusion die by a series of horizontally and vertically micrometer adjustable heated precision rollers (29).
5. A method as claimed in of claims 1 to 4 wherein after the plastics material is attached the assembly passes to a heating zone (30) to cure the adhesive resin and effect bonding of the matrix.
6. A method as claimed in any of claims 1 to 5 wherein after curing the resin the assembly is cooled (32), pulled off (12) and further assembled in-line (34) with a double-sided pressure sensitive adhesive tape to the bottom of the matrix, and thereafter cut into suitable lengths for packaging and onward transmission.
7. A method as claimed in any claims 1 to 6 wherein the plastic material (22) adhered to the steel strip is polypropylene.

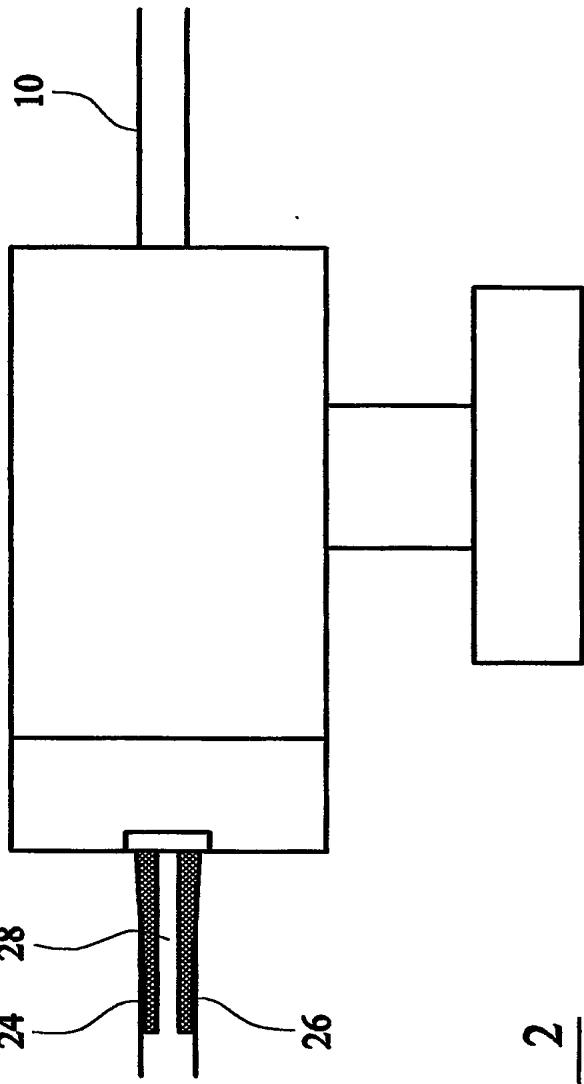
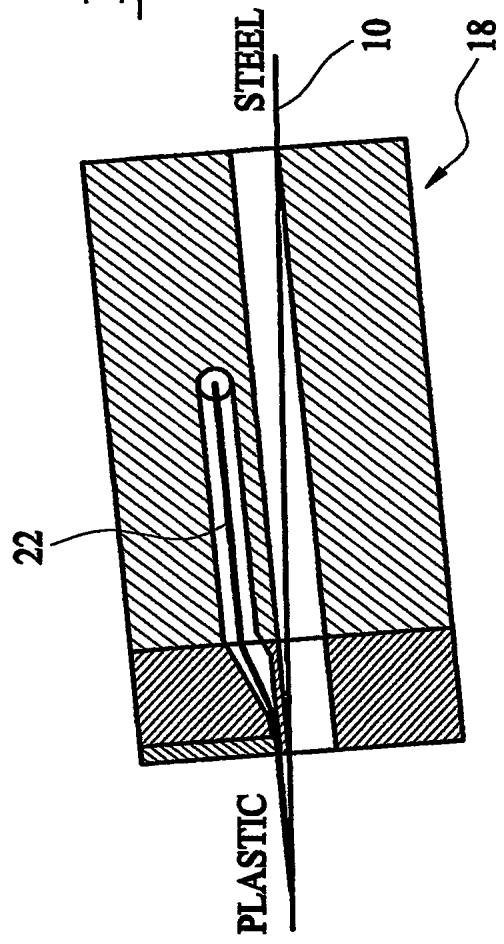
-6-

8. A method as claimed in any of claims 1 to 7 wherein the metallic material is steel.
9. A method as claimed in claim 8 wherein the strip (10) is conditioned and degreased before use.
10. A matrix assembly made by a method as claimed in any claims 1 to 9.

**PRIMA - SCORE LINE SCHEMATICS****FIG. 1**

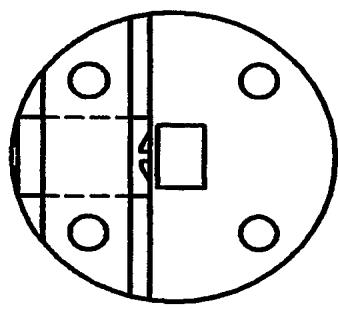
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**FIG. 3**



**FIG. 2**

**FIG. 4**



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A. CLASSIFICATION OF SUBJECT MATTER				
IPC 7	B26F1/44	B23P15/40	B29C47/02	B32B31/30

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 094 056 A (TAKEDA SHINJI ET AL) 13 June 1978 (1978-06-13) column 2, line 55 -column 3, line 33 column 4, line 34 - line 45 claims 1-7; figure 1	1,10
Y	---	2-9
X	FR 2 682 317 A (PROFIL) 16 April 1993 (1993-04-16) page 1, line 17 - line 28 page 3, line 14 -page 4, line 17; claims 1-4; figures 1,2	1,10
A	---	2-9
	-/-	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 107 490 A (SNODGRASS FRANCIS MATTLAGE) 2 May 1984 (1984-05-02) cited in the application page 7, line 9 - line 24 page 8, line 11 - line 24 claims 1,7-12; figures ---	6-9
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